

## Rotator cuff injuries: Magnetic resonance imaging observation and comparison with arthroscopy

Rotator cuff injuries

Minh-Hoang Nguyen, Ngoc-Thanh Do, Huu-Hung Phan, Quang-Tri Lê  
Department of Orthopedics, 7A Military Hospital, Ho Chi Minh City, Viet Nam

### Abstract

**Aims:** This study aimed to evaluate the injuries on rotator cuff observed by magnetic resonance imaging (MRI) and arthroscopy.

**Methods:** The study investigated 97 patients (66 males, 31 females) with averaged age of 52.4 (8.1) years (30 – 74 years) treated in the Department of Orthopedics, 7A Military Hospital from Jan 2016 to Dec 2018. The study diagnosed the rotator cuff injuries by MRI then treated the injuries by arthroscopy.

**Results:** Compatibility between MRI and arthroscopy observation was 65.5% for partial rotator tear on the bursal side, 55% on the articular side 79.2% for full tear.

**Discussion:** Rotator cuff tear mostly occurred in middle-aged and geriatric patients. MRI diagnosis was mostly agreeable with arthroscopy in the cases of full tear but less so in cases of partial tear.

**Conclusion:** MRI has high accuracy in diagnosis of rotator cuff tear, especially the full rotator cuff tear.

### Keywords

Rotator cuff, Magnetic-Resonance imaging, Arthroscopy

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Corresponding Author: Quang-Tri Le, Director of 7A Military Hospital, Head of Department of Orthopedics, Head of Department of High-Tech Diagnostics, 466 Nguyen Trai Street, Ward 8, District 5, Ho Chi Minh City, 72706, Viet Nam

E-mail: lqtri@ntt.edu.vn P: (+084)0839241868 / (+084)0913126229

Corresponding Author ORCID ID: <https://orcid.org/0000-0002-2777-0828>

Introduction

Rotator cuff tear is a common shoulder injury which causes pain and impairment of working and daily activities. Detection of rotation cuff injuries can be challenging as many cases are asymptomatic [1,2]. Ultrasonography, magnetic resonance imaging (MRI) and arthroscopy are amongst the many diagnosis methods for rotator cuff tear, each of them has its own advantages and accuracy for the diagnosis of various shoulder damages. The current standard diagnosis for shoulder issues is arthroscopy; however this invasive method requires hospitalization and anesthesia and has a risk of complications. Magnetic resonance imaging (MRI) can be considered as a non-invasive alternative which can provide useful information of the shoulder conditions; the advantages of high sensitivity and accuracy, excellent soft-tissue resolution and multi-planar imaging capabilities enable this method to be a popular choice for rotator cuff preoperative examination [3,4]. In order to develop an accurate and quick diagnosis of rotator cuff pathologic issues to for an effective therapy, this study was aimed to compare the observation results of shoulder injuries using MRI and arthroscopy.

Material and Methods

Experimental participant

This study investigated 97 patients (66 males 31 females) with average age of 52.4 (8.1) years (30-74 years) diagnosed with rotator cuff tear and treated at Department of Orthopedics, 7A Military Hospital from Jan 2016 to Dec 2018.

Study design

This study utilized a descriptive and prospective approach with compare and contrast. The observed images of rotator cuff and shoulder injuries collected by MRI and shoulder arthroscopy were compared to identify the compatible and incompatible cases between MRI and arthroscopy results for rotator cuff injuries, including partial tear on the bursal side, partial tear on the articular side, and full tear. Data analysis was performed by SPSS 22.0 using the medical algorithm.

Ethical Declaration

The patients and relatives were well-informed about their conditions and equal treatment and were asked to take part in the study. The participation was strictly voluntary, verified by signed documents. Medicine Scientific Research Ethics Committee of the 7A Military Hospital approved this study (Number: 13/QĐ-HĐYĐ-BV7A, date: 29.01.2016). This study is original and is not published in other scientific journals.

Results

General information

Patients' sexes and ages were presented in Table 1. Average age of the patients was 52.4 (8.1) years (30 – 74 years) and the most frequent age group was 45 – 65 years which had high occurrence in both genders (76.2%). There was 66 male patients and 31 patients with corresponding gender ratio of 2.1 : 1.

Rotator cuff tear based on MRI and arthroscopy results

Based on MRI images, 29 cases (29.9%) had a partial tear on the bursal side, 20 cases (20.6%) had a partial tear on the

articular side and 48 cases (49.5%) had full tears. Based on arthroscopy results, 30 cases (30.9%) had a partial tear on the bursal side, 18 cases (18.6%) had a partial tear on the articular side and 49 cases (40.5%) had a full tear.

Compatibility of rotator cuff tears images between MRI and arthroscopy

Amongst 29 cases of bursal side partial tear based on MRI, 19 cases were compatible with arthroscopy results (65.5%) and 10 cases were not compatible (35.5%). Amongst the 10 incompatible cases, 2 cases had arthroscopy results of articular side partial tear (6.9%) and 8 cases of full tear (27.6%). Amongst 20 cases of articular side partial tear based on MRI, 11 cases were compatible with arthroscopy results (55%) and 9 cases were not compatible (45%). Amongst the 9 incompatible cases, 7 cases had arthroscopy results of bursal side partial tear (35%) and 2 cases of full tear (10%). Amongst 48 cases of full tear based on MRI, 38 cases were compatible with arthroscopy results (79.2%) and 10 cases were not compatible (20.8%). Amongst the 10 incompatible cases, 7 cases had arthroscopy results of articular side (35%) and 2 cases of bursal side partial tear (10%).

Table 1. Patient's ages and sexes

Ages	Gender				Total	%
	Male		Female			
	n	%	n	%		
<35	5	7.6	1	3.2	6	6.2
35 – <45	10	15.2	3	9.7	13	13.4
45 – <55	26	39.4	11	35.5	37	38.1
55 – <65	22	33.3	15	48.4	37	38.1
65 – 75	3	4.5	1	3.2	4	4.2
Total	66	100	31	100	97	100
Average age (SD)	49.8 (9.8) years		55.6 (8.2) years		52.4 (8.1) years	
Lowest – highest ages	30 – 74 years		34 – 69 years		30 – 74 years	

Discussion

Rotator cuff tear mostly occurred in middle-aged and geriatric patients in this study, with the aged group of 45 – 65 years accounted for 76.2% of the cases. Muthami et al. (2014) observed a 24% prevalence in age 45 – 40 and concluded that rotator cuff pathologic issues often occur in middle-aged and geriatric population [5]. McMonagle and Vinson (2012) noted that rotator cuff tears are often asymptomatic hence its accurate prevalence is unclear, but in general geriatric population is more prone to this issue, which is compatible with our study [1]. The male : female ratio in our study was 2.2 : 1. Sharma et al. (2017) reported similar statistics with the average age of 50.39 years and the gender ratio of 1.5 : 1 [3]. Meanwhile, Aliprandi et al. (2017) reported near equality in gender (64 males, 62 females) [6] and Lambert (2009) reported a reverse ratio of 1 : 4, probably due to differences in studied populations and samples [7]. In both diagnosis methods, dull rotator cuff tear made up of the majority and the difference between partial tear on the bursal side and articular side was not significant. The difference between MRI and arthroscopy outcomes was not significant. Based on MRI results, rotator cuff full tear was 1.7 times more

frequent than bursal side partial tear and 2.4 times more than articular side partial tear. Sharma et al. (2017) also reported a dominant rate of full tear (29/45 cases, 64.44%) over partial tear (15/45 cases, 13.33%) [3]. Aliprandi et al. (2017) reported 56% full tears and 44% partial tears [6]. Meanwhile, the research of Waldt (2007) on shoulder MR arthrography and arthroscopy of 275 patients reported 197 cases of rotator cuff tears, in which 92 cases (46.7%) had full tear and 105 cases (53.3%) had partial tear [8], and Hapani et al. (2017) reported 10/27 patients (37%) with full tears and 17/27 patients (63%) with partial tears [9]. The difference was probably due to the differences of investigated populations and samples. We hence proposed a further studies to better estimate the gender and injury type ratios of rotator cuff injury.

Diagnosis of bursal side partial tear using arthroscopy was difficult as inflammatory hyperplasia tissues would fully cover the rotator cuff. Ultrasonography and MRI have been more popular for diagnosis but both methods are not very effective for partial tears. Xiao et al. (2010) reported a 74.3% accuracy [10]. Magee (2006) claimed that MRI using Tesla 3 device has 84% higher sensitivity, increased ratio over noise and resolution [11].

Rotator cuff partial tear on the articular side was detected on the coronal plane using T1FS and T2FS imaging of MRI. T2W and T2FS imaging had lower accuracy than T1FS since they could not effectively differentiate bursal capsule inflammation from the diffusion of shoulder joint fluid to the MCV cavity in cases of a full tear.

The results showed that MRI diagnosis for rotator cuff full tear had high accuracy and compatible with other studies such as Waldt (2007) [8], Hapani et al. (2017) [9], and Roy et al. (2015) [12].

This study showed that MRI was highly accurate in diagnosis of rotator cuff full tear but performed poorly in diagnosis of partial tear; arthroscopic results verified excellent sensitivity of MRI for cases of full tear but not for partial tear [13]. Other reports such as Sharma et al. (2017), Roy et al. (2015) and Hapani et al. (2017) also favor the case of full tear over partial tear, although the partial tear outcomes in these work were also high [3] [9] [12]. More recently developed techniques can improve the sensitivity in cases of partial tear such as fat suppression which increases the signal contrast on T2W images and improves diagnosis of rotator cuff partial tear. Xiao et al. (2010) also recommended fat suppression as it made fluid-intensity signal within the tendons become more visible [10]. Quinn and Demlow (1995) reported 82% sensitivity and 99% specific in 11 partial tear cases in comparison with arthroscopy when using fat-suppression techniques [14].

Compatibility between MRI specialists and surgeons were also an issue [8]. The compatibility was very high in cases of rotator cuff full tear but poor in cases of partial tear.

### Conclusion

Results of rotator cuff injury diagnosis using MRI was highly compatible with arthroscopy, achieved the highest compatibility in cases of full tear (79.2%), followed by bursal side partial tear (65.5%) and articular side partial tear (55.0%).

### Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

### Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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### Conflict of interest

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